

INTERIM REPORT IR-97-034/September

The Development of an International Agenda for Climate Change: Connecting Science to Policy

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Abstract

The observation has been made that the climate change issue broke onto the international policy making agenda in the mid 1980s, between 1985 and 1988. The issue moved from the realm of science to the realm of politics. As such, this period provides fertile ground for exploration of the relationship between science, knowledge, and action on international environmental issues. This relationship is the emphasis of this study, as it provides an account of the transition of climate change to the international policy agenda. This study explores the often made claim that it was the development of a scientific consensus, a reframing of the climate debate, and attention from an international group of scientists that pushed the issue into the international political spotlight by the late 1980s. The Villach 1985 conference is often cited as the source for these claims. This study contends that the 1985 Villach conference did not represent a significant change in scientific conclusions about the problems of climate change. Rather, a new emphasis on certain scientific facts, the unique quality of the international group of scientists, and new perceptions of the opportunity for action on international environmental problems led the Villach group to reach a new set of political and policy conclusions which emphasized the urgency of action. Several policy and science entrepreneurs advocated action to address problems of global environmental change. Their conclusions coincided with a number of other developments, including extreme weather in the United States and the successful negotiation of an international agreement to protect the ozone layer, which pressed in the direction of further international attention to environmental problems. By 1988, a variety of international players were involved in shaping the debate about responses to climate change.

Citation, Context and Reproduction

This paper may be cited as: Wendy E. Franz. "The Development of an International Agenda for Climate Change: Connecting Science to Policy." ENRP Discussion Paper E-97-07, Kennedy School of Government, Harvard University, August 1997 and also as International Institute for Applied Systems Analysis Interim Report IR-97-034/August.

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The Global Environmental Assessment (GEA) project is a collaborative team study of global environmental assessment as a link between science and policy. The Team is based at Harvard University, but includes substantial contributions from the International Institute for Applied Systems Analysis (IIASA) in Austria, Cornell University, Duke University and the Center for Integrated Study of the Human Dimensions of Global Change at Carnegie Mellon University. The project has two principal objectives. The first is to develop a more realistic and synoptic model of the actual relationships among science, assessment, and management in social responses to global change, and to use that model to understand, critique, and improve current practice of assessment as a bridge between science and policy making. The second is to elucidate a strategy of adaptive assessment and policy for global environmental problems, along with the methods and institutions to implement such a strategy in the real world.

The GEA Project is supported by a core grant from the National Science Foundation (Award No. SBR-9521910) for the "Global Environmental Assessment Team." Additional support is provided by the Department of Energy (Award No. DE-FG02-95ER62122) for the project "Assessment Strategies for Global Environmental Change," the National Institute for Global Environmental Change Great Plains Office (Award No. LWT 62-123-06518) for the project "Towards Useful Integrated Assessments: A Bottom-up Approach," the Belfer Center for Science and International Affairs, the International Institute for Applied Systems Analysis, and the Center for Integrated Study of the Human Dimensions of Global Change at Carnegie Mellon University.

Publication abstracts of the GEA Project can be found on the GEA Web Page at <http://www.ksg.harvard.edu/bcsia/enrp/gea>. Further information on the Global Environmental Assessment project can be obtained from the Project Associate Director,

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Acronym List

AES	Atmospheric Environment Service (Canada)
AGGG	Advisory Group on Greenhouse Gases
CAN	Climate Action Network
ICSU	International Council of Scientific Unions
INC	Intergovernmental Negotiating Committee
IPCC	Intergovernmental Panel on Climate Change
NAS	National Academy of Sciences
NGO	Non-governmental Organization
NRC	National Research Council
SCOPE	Scientific Committee on Problems of the Environment
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
UNGA	United Nations General Assembly
WCED	World Commission on Environment and Development
WMO	World Meteorological Organization
WRI	World Resources Institute

The Development of an International Agenda for Climate Change: Connecting Science to Policy

Wendy E. Franz

Introductionⁱ

The observation has been made that the climate change issue broke onto the international policy making agenda in the mid 1980s, between 1985 and 1988. The Toronto Conference of 1988 represented a major policy declaration on global warming, calling for a 20% reduction in global CO₂ emissions by the year 2005. The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 (though proposals for it were circulating as early as 1987), and in 1989 a high level ministerial conference was held in Noordwijk, Netherlands, as intergovernmental science and policy discussions began in earnest. The 1989 Group of Seven Economic Summit in Paris featured environmental issues. At the same time, a group of international non-governmental organizations formed the Climate Action Network (CAN) for improved communication on the climate issue. By 1990, the Intergovernmental Negotiating Committee (INC) had received its charge from the UN General Assembly, and the committee began to meet in early 1991. An issue that had been the domain of climatologists, oceanographers, and scientific bureaucracies moved rapidly into the domain of international policy analysts, the public, environment ministers, presidents and prime ministers. As one observer noted “[a]ll of the sudden [climate change] was on the [political] agenda”.

As such, this period provides fertile ground for exploration of the relationship between science, knowledge, and action on international environmental issues. This relationship is the particular emphasis of this study, as it provides an account of the transition of climate change to the international policy agenda.

Connecting Science to Policy in Climate Change

There are many ways in which science may intersect with knowledge and action. Spectacular scientific findings may spawn a series of congressional hearings or greater

public attention to a particular issue, science advisory panels may consult with national or international decision makers, or scientists may be consulted on an ad hoc basis as circumstances warrant. Scientific knowledge may also be organized, evaluated, integrated, and presented in documents intended to focus and coalesce action for further scientific research or policy action.ⁱⁱ This latter form of the science / action linkage is, in general, known as a scientific assessment. It is with this form of the linkage that this study will be concerned.

Most accounts of the transition of the climate change issue from the international science agenda to the international policy agenda make note of the importance of several international assessments and conferences. The series of international assessments organized and carried out by the International Council of Scientific Unions (ICSU), the World Meteorological Organization (WMO), and the United Nations Environment Programme (UNEP) in the 1980s have generally merited special attention. In particular, the International Conference on the Assessment of the Role of Carbon Dioxide and of Other Greenhouse Gases in Climate Variations and Associated Impacts at Villach, Austria in October 1985 (based upon a report issued by the Scientific Committee on Problems of the Environment and eventually published as a World Climate Programme report), and workshops held in Villach, Austria, and Bellagio, Italy in 1987 have been identified as contributors to the development of the international agenda on climate change. In general however, accounts of the development of the international policy agenda emphasize that these events roughly coincide with the burst of international interest in climate change, making minimal claims about the reasons for attributing importance to these assessments. Such accounts, while many provide excellent accounts of the history of the climate change issue, rarely reach any conclusions about the ways, if any, in which these assessments bore on the policy making process (see for example, Bodansky, 1992; the Social Learning Group, 1998; Hecht and Tirpak, 1995; Pomerance, 1989; Boehmer-Christiansen, 1994a, 1994b).

In contrast, this study explores the direct links between scientific assessments and the development of international policy initiatives. It asks the following general questions. Did these assessments appear to have informed the agenda setting process if so, how? Were there other contextual events that have shaped not only the intersection of knowledge and policy, but led states to take an interest in climate change at the international level? In particular, this study asks how accurate is the perception that the series of international assessments organized and carried out by ICSU, WMO, and UNEP, were critical to the connections drawn between scientific knowledge and policy? Did these assessments say something new, or did they say something differently? If yes, why? Were these assessments advocated (or criticized) by particular groups? How were the messages of these assessments carried, translated, or transmitted by the assessors or other observers? What influence did the hot summer of 1988 and the ongoing negotiations on the ozone issue have on the process of connecting climate science to climate action?

Several conjectures about the forces which shape the connection between knowledge and policy can be drawn from international relations theory, writings on the role of science in

policy making, and from several specific accounts of this period of time. Several treatments of science and international relations have emphasized that scientific consensus is often a crucial factor in catalyzing international agreement. This study will evaluate the science as it is presented in the international assessments series and the extent to which these assessments reached new or different scientific conclusions. In addition, the extent to which the different framings of a problem result in different arrays of interests and actions will also be explored. In the case of climate change, much has been made of a change in the definition of the climate change problem from one of carbon dioxide and energy, to one of carbon dioxide plus other greenhouse gases. Other international relations theorists have emphasized the importance of the constellation of interests and international institutions. In this respect, the backdrop of international politics, including the status of other environmental agreements, will be considered, in addition to the role that the UNEP, ICSU, and the WMO played in catalyzing action. Studies of agenda setting in American politics suggest that the role of chance events cannot be underestimated. In this case, the hot summer of 1988 in the United States is an important consideration. This study, as a contribution to the endeavor of understanding the role of scientific assessments in managing global environmental risks, will also seek to mine the historical record of the international series of assessments for new lessons.

This study will contend that the 1985 Villach process did not represent a significant change in scientific conclusions about the problems of climate change. Rather, a new emphasis on certain scientific facts, the unique quality of the international group of scientists, and new perceptions of the opportunity for action on international environmental problems led the Villach group to reach a new set of political and policy conclusions which emphasized the urgency of action. These conclusions coincided with a number of other developments which pressed in the direction of further international attention to environmental problems, and the Villach findings were used to reinforce the case of others interested in action to address the problems of global climatic change. The reasons for the use of Villach findings had less to do with the new emphasis on scientific facts, and more to do with the advocacy of the findings by some participants in a variety of fora and the utility of using the conclusions reached by an international group. It is important to recognize that some of the factors which influenced the nature of the Villach conclusions may also have shaped the state of the climate change issue on the international agenda. As such, the assessments themselves may be intervening variables. In the ultimate analysis, the shape of the debate in the late 1980s about responses to climate change bore little resemblance to the conclusions that were reached at Villach, although a push by the group to formulate policy relevant targets and timetables was continued.

The Agenda

The phrase “climate change was on the international agenda” merits a close examination. What is meant by it? How can this claim be evaluated? Who are the relevant actors? Studies of domestic public policy making have used a variety of common sense

indicators for the presence of an issue on the agenda. John Kingdon's oft cited book on domestic agenda setting notes that an issue is on the agenda if government actors (administration officials, civil servants, and legislators) and actors outside government closely associated with government actors (interest groups, academics, the media) are paying serious attention to it. Other studies have adopted similar arenas of focus, exploring congressional records and the level of media attention to identify issues that are on the agenda (see for example, Baumgartner and Jones, 1993; the Social Learning Group, 1998).

For purposes of the study at hand, the international agenda differs in some significant ways from the domestic agenda, and actors specific to environmental issues can be identified. The next several paragraphs delineate the way in which this study conceives of "the international agenda".

In the case of an issue with significant scientific and technical components like climate change, it is reasonable expect that the issue may be one that is on the agenda of scientists. In the international arena, groups of scientists from around the world may be engaged in forging common research plans, holding conferences, or conducting scientific assessments. For example, in the case of arms control, groups of scientists from both the United States and the Soviet Union were holding joint discussions on nuclear technology, long before talks between members of government agencies, or heads of state took place. Many issues that might be considered to be on "the international agenda" thrive at the level of scientific coordination.

An issue might be deemed to be on the international agenda at some level if international organizations have considered the issue in their governing boards, have allocated resources to support work on the issue, or have initiated specific projects. The United Nations Environment Programme, for example, put the issue of ozone depletion on its agenda in 1975 when it began producing internal reports on ozone depletion and began deliberations about further institutional responses. In 1977, UNEP created the Programme on the Protection of the Ozone Layer.

It might be difficult to differentiate a political from a scientific agenda (after all, the project of which this paper is but a part focuses on the very political nature of the creation of a scientific agenda), but it is important to identify arenas of discussion which might be deemed to be political. For example, a United Nations General Assembly (UNGA) Resolution to pursue international attention and negotiation on an issue might be one indicator that an issue is on the international political agenda. However, if the UNGA calls for action and nation states do not respond, the issue is a dead letter. As such, an issue may be said to be on the international political agenda if it attracts the attention of nations, represented by high level government officials or leaders.

The place of the issue on domestic agendas may determine the response of national governments at the international level. Attention to the issue by representatives of national governments (i.e. cabinet level personnel, or heads of state), particularly when voiced in international fora is indicative of an agenda presence for that issue. Domestically, it is also important to consider what might be called a public agenda,

judged through attention in national legislative bodies, or through the attention that is paid by the media, the public, or non-governmental organizations.

The above narrative is not to suggest that an issue proceeds from one kind of agenda to another in a predictable manner. The presence of an issue in the media may as easily reflect the state of the issue on one agenda as it may push the issue onto other agendas. Concerns of national leaders may shape, fund, or encourage efforts on the parts of international teams of scientists. However, for purposes of this paper, it will be important to identify, to the extent that it is possible, who is paying attention to the issue of climate change, when they paid attention, and what the plausible explanation for that attention may be. The general view of several international scientists and policy makers on the issue of climate change is clear. The issue of climate change moved from a mostly scientific arena into an international political one with increasing intensity. By 1990, the issue had the attention of all of the actors outlined above. Of interest here is the extent to which assessments contributed to, or shaped, the international agenda.

Scientific Consensus, Frame Changes, and Internationalization

Conventional wisdom about the international assessments of the mid 1980s is captured by Jill Jaeger (a participant in the series of assessments in question) and Tim O’Riordan in the following statement about the Villach 1985 meeting: “[s]cenarios for future emissions of all of the significant greenhouse gases, not just CO₂, were considered and an international scientific consensus about the potential seriousness of the problem was achieved. The problem of anthropogenic climate change was moved at this point onto the political agenda” (Jaeger and O’Riordan, 1996, p. 14, emphasis added). There are three components of this statement, all of which point to explanations for the emergence of the climate issue on the political agenda. The first is the general claim that scientific consensus about the seriousness of the problem was achieved. The second is that greenhouse gases in addition to CO₂ were considered. The third is that the conclusions were reached by an international group of scientists, working under the auspices of international agencies. Each of these components may be important in the case of climate change. As noted in the introduction, previous work on issues concerned with international issues that have scientific or technical components, in addition to work done specifically on the climate change issue, point to the potential importance of these components, or characteristics of assessment. The evaluation of these components will be a three step process. First, justification for the importance of these characteristics from existing literature will be elaborated. Second, evidence from the international assessment conducted by the Scientific Committee on Problems of the Environment (SCOPE) and its associated conference will be presented and used to determine the extent to which the claims are accurate. Finally, the extent to which these characteristics mattered in the course of the development of responses to climate change will be evaluated.

Scientific Consensus

Scientific consensus is often identified as a major contributor to decisions to cooperate in international policy making. Richard Cooper's account of the development of international public health guidelines from the 19th century supports this claim. Before much was known about diseases such as cholera, malaria, and the bubonic plague, countries adopted wildly different disease control guidelines, if any at all. International congresses on the subject were marked by tremendous conflict and generally failed to reach cooperative measures. It was not until the early 1900s, when scientific consensus had developed, that international cooperation emerged. As Cooper concludes, "[s]o long as costs are positive and benefits are uncertain, countries are not likely to cooperate systematically with one another; and so long as sharply differing views are held on the relationship between actions and outcomes, at least some parties will question the benefits alleged to flow from any particular proposed course of action" (Cooper, 1989, p. 180-81).

Other accounts corroborate Cooper's claims. In Peter Haas's account of action to save the Mediterranean Sea, consensus among a group of scientists who were able to penetrate the national policy making apparatus at high levels was the key to cooperation and a necessary condition for the creation of the Mediterranean Plan. Richard Benedick, in his account of the negotiation of the Montreal Protocol, suggested that the role of science was "indispensable" in its success. It was not simply scientific theories and discoveries that were critical, but the development of consensus about the problem. He writes: "The best scientists and the most advanced technological resources had to be brought together in a cooperative effort to build an international scientific consensus" (Benedick, 1991, p. 5). He contends that an international agreement on ozone could not have occurred at any earlier point in history, due, at least in large part, to the state of scientific agreement about the problem. Steven Krasner notes that "[w]ithout consensus, knowledge can have little impact on regime development in a world of sovereign states" (Krasner, 1983, p. 20). The idea expressed by these observers is that some agreement about the problem and the relationship between cause and effect is an important determinant of the extent to which policy and political attention is paid to an issue, as well as the likelihood of international cooperation.ⁱⁱⁱ

Observers of the development of the climate change issue, in addition to Jaeger and O'Riordan, suggested that the reason the climate change issue was paid serious attention in the mid 1980s had essentially to do with the maturity of science, referring to consensus in a slightly different way. By the mid 1980s, Peter Usher, of the United Nations Environment Programme noted, "the science was solid" (Usher, 1997). Pier Vellinga, a coastal engineer from the Netherlands observed that "the pot was boiling" (Vellinga, 1997). While the evidence presented at the first World Climate Conference in 1979 "was scary", it took several years for scientists to come up with more evidence, according to Vellinga. These claims suggest that the conclusions reached by the large gathering of scientists in 1985, based upon the results in the SCOPE study, represented greater agreement than had hitherto been present in the international scientific community. This is the first claim that will be evaluated in this study.

Issue Framing

Several analyses of the politics of international environmental problem solving have suggested that the way in which a problem is framed may have ramifications for policy choices. Thomas Bernauer, Barbara Connolly and Martin List note in their discussions of the formulation of financial mechanisms for environmental protection that the ways in which problems are defined bear directly on how action is taken. In Bernauer's case study, the initial framing of the problem of Rhine River pollution was useless from the perspective of solution development. In the case of nuclear safety, because the problem was framed in a particular way, the solution adopted was retrofitting of reactors, rather than shutdown. In these cases, both political forces (interest group lobbying and institutional form) and scientific forces directed these outcomes (Bernauer, 1996; Connolly and List, 1996).

Several accounts of the development of the climate change issue make a great deal of the addition of other greenhouse gases to the calculus of the rate of climatic change. Jill Jaeger and O'Riordan, in elaborating their claims about the new developments that had emerged by 1985, noted that while scientific papers existed as early as 1975 which linked other greenhouse gases to the problems of climate change, "the policy implications of this finding were only slowly realized and the issue of anthropogenic climate change was still framed as a 'CO₂ problem' until the mid-1980s" (Jaeger and O'Riordan, 1996, p. 14; Jaeger, 1997).

Several people have suggested that the Villach conference was critical to altering the framing of the climate change issue. Rather than being an issue which centered around CO₂, energy, and fossil fuels, the problem was one which included other greenhouse gases and a complex of environmental issues, and it became a problem that warranted immediate attention. Alan Hecht and Dennis Tirpak also cite the Villach conference conclusions, drawing on the Ramanathan paper, as essential to the progress of the climate change debate: "The information moved the spotlight from CO₂ to all trace gases and accelerated interest in the need for policy actions" (1995, p. 380). Clark and Dickson, in their study of learning about environmental risks, observed that "[a] wider national debate on the greenhouse effect would begin to take shape only when America's narrow energy/CO₂/climate framing of the issue was broken open in the mid-1980s -- principally in response to developments in the international arena" (1998, p. 17). Villach was a "catalytic event" for this shift. "Villach's reframing of the climate issue allowed it to be amplified through independently increasing concerns over stratospheric ozone depletion." (Clark and Dickson, 1998, p. 18). The claim that the framing of the issue that emerged in the Villach report was new, "catalytic", and critical to furthering a wider policy debate will be the second claim that this study evaluates.

Internationalization

In Peter Haas's (1990) account of the Mediterranean Plan, Richard Benedick's (1991) account of the negotiation of the Montreal Protocol, in addition to the studies conducted

by Marc Levy and Ted Parson (1993) in an edited volume on the subject of international institutions and environmental protection, the importance of placing the nexus of scientific discussion at the international level, and in international institutions, is clearly articulated. International institutions may use science to magnify concern about environmental problems and transform the prospects for international. Richard Benedick's account of the development of the agreement to protect the earth's ozone layer noted that the collaboration of an international panel of scientists was critical to the success of this agreement. Peter Usher, the UNEP representative to the ozone negotiations, concurred with this characterization (Usher, 1997). Peter M. Haas and David McCabe (1998) conclude, in their study of the role of international institutions in the cases of ozone, acid rain, and climate, that access to international institutions contributed to the ability of a group of scientists to disperse the message about climate change. Sonia Boehmer-Christiansen, in her comprehensive account of the development of climate science and climate politics suggests that "[t]he climate threat was raised successfully in 1985 by a formidable alliance of experienced research managers and influential institutions meeting in Villach for the Second Joint UNEP/ICSU/WMO International Assessment of the Role of Carbon Dioxide and other Greenhouse Gases in Climate Variations and Associated Impacts" (1994a, p. 155).

Participants in several assessments during the early 1980s observed that it was time for an international assessment. Bert Bolin, director of the SCOPE report, observed that "international assessment was necessary in order to establish the global importance of the issue" (1994, p. 26). The claim that the international composition and sponsorship played a role in shaping this outcome will be the third claim explored here.

Was Villach Different?

At the international level, the World Climate Conference, held in 1979, represented an early major statement on climate change. The conference was organized by the World Meteorological Organization. The conference called on all nations to unite in efforts to understand climate change and to plan for it, but it did not call for action to prevent future climate change although this point was discussed at the time (Kellogg, 1987, p. 124). In his keynote address, Robert White, the chair of the conference, noted that "the Executive Committee of the WMO has specifically asked this Conference to recommend whether a conference at the ministerial level should be convened to take necessary international actions" (WMO, 1979, p. 8). Conference participants ultimately recommended more research, which would require coordination among international bodies. However, the declaration noted that "It is fully recognized that the international co-operation which is the prerequisite for any world climate programme can only be successfully pursued under conditions of peace" (WMO, 1979, p. 716).

A joint conference, sponsored by UNEP, WMO and ICSU, under the auspices of their jointly sponsored World Climate Programme, was held in Villach, Austria in 1980. Its purpose was to provide a "carefully prepared scientific assessment of the CO₂ question to provide them with guidance in their future activities and advice to nations" (World

Climate Programme, 1981, p. 2) Experts on the assessment of the role of CO₂ on climate variations and their impact contributed reviews of observed changes of CO₂, the man-made sources of CO₂ and the role of the biosphere, the carbon cycle and the prediction of future atmospheric CO₂ concentrations, climate change due to increasing CO₂, cryosphere and ecosystem effects, in addition to economic and social impacts. The conference concluded that “[t]he probability that potentially serious impacts may be realized is sufficiently great that an international commitment to a programme of co-operation in research is required to illuminate the issues and to reduce uncertainties so that the dimensions and time scale of the problem can be more reliably ascertained.” However, the assessment concluded that because of existing scientific uncertainties, the development of management plan for CO₂ was premature.

The sponsoring organizations agreed to the conduct of another assessment, due in 1985. This assessment, and an associated conference, would be coordinated by UNEP, WMO, and ICSU. These institutions did hold an interim study conference in 1983, “On Sensitivity of Ecosystems and Society to Climate Change” (World Climate Programme, 1984). This was essentially an impact assessment, which brought biologists and climate modelers together. The goal was for biologists “to define the scope of their impact research in light of the climate modeling capabilities, and climate modelers [to] identify the key climate variables required for impact assessment” (World Climate Programme, 1984, p. 3).

An introduction to the 1983 report noted that “some advances in our understanding of the problem of CO₂ induced climatic changes has taken place” since Villach-1 (1980). The introduction was based upon reports presented by scientists Bolin, Gates, MacCracken, and Wigley. A summary of key points, however, reveals very little change in many of the essential findings. In the case of a few estimates, the range of uncertainty was widened as the result of further analysis. The report suggested that pre-industrial concentrations of CO₂ were lower than had been previously thought, and as such, the increase in CO₂ concentrations from pre-industrial concentrations was 22 - 31%. Projections of future concentrations of CO₂ were considered to remain unchanged (440 ppm plus or minus 10 by 2025), (although new estimates of pre-industrial levels meant that by 2025, this figure would represent a 70% (plus or minus 20) increase). General circulation models (GCMs) confirmed previous results of a 1.5 - 4° C increase in global surface temperature, though the range of uncertainty could actually be larger, given “a fuller recognition of the omission of several, possibly important, feed-back mechanisms”. Continued work on “estimating past emissions due to fossil fuel combustion, deforestation and changing land use have not altered significantly the estimated values given in Villach-1” (World Climate Programme, 1984, p. 3). As this was a conference to focus on the sensitivity of various ecosystems, and not to evaluate the general claims about global climate change, the conference went no further than recommending further work on impact assessments.

The assessment that formed the background for the 1985 conference was published by SCOPE, a committee of ICSU; it was funded primarily by UNEP, in addition to the WMO, SCOPE/ICSU, the World Resources Institute (WRI) and the Swedish Board for Energy Research and the International Meteorological Institute in Stockholm (SCOPE,

1986, p. xvii). Work on the assessment was conducted at the International Meteorological Institute in Stockholm beginning in 1982 (Bolin, 1994, p. 26). The report noted that while “a number of assessments of [the possibility of climatic change] have been made by national groups, notably in the United States”, “[t]he problem is clearly an international one and an assessment at the international level therefore seems desirable to serve as a basis for discussion and possibly, at some stage, for the development of an action plan” (SCOPE, 1986, p. xv).

Several accounts of the development of climate science suggested that the SCOPE report and its associated conference reached the kind of agreement about the science of climate change that made the relationship between action and outcomes clear, and provided a basis for knowledge to inform decision making. Evaluation of this consensus claim is very straightforward. The scientific conclusions of the SCOPE report can be compared to the conclusions of assessments that were issued before it. The questions that must be asked include the following: what were the major conclusions of this assessment and how to they compare to previous international assessments? How do they compare to national assessments? What were the claims made about consensus?

The SCOPE report presented the following major findings. It reported on current levels of CO₂ concentrations, and suggest that other greenhouse gases may be equally important. It made estimates for climatic change, and evaluates the effect of such changes on sea level, agriculture, and ecosystems.

The report noted an observed increase in CO₂ concentrations to 343 ppmv (1984) from 315 ppmv (1958). They noted that they knew the amount of CO₂ emitted by fossil fuel combustion and changing land use. As such, the observed increase can be related to human activities. Future global energy demand will determine future emissions. Based on this information, the report estimated a range of concentration increases, the upper bound of which implies that CO₂ concentrations might double by the middle of the next century (2050), while the lower bound implies that a doubling of CO₂ concentration will not be reached until 2100 (p. xxvii).

Other greenhouse gases and aerosols are also an important part of the equation. The report concluded that the equilibrium temperature change due to increasing concentrations of other greenhouse gases and aerosols is estimated to be about half of the temperature change attributed to the increase of atmospheric CO₂ alone. “The combined concentrations of atmospheric CO₂ and other greenhouse gases would be equivalent to a doubling of CO₂ possibly as early as the third decade of the next century” (SCOPE, 1986, p. xxvii). CFCs may become as important as CO₂, but the report acknowledged that the biogeochemical cycles of other GHGs are little understood, and the report finds the data “inadequate as a basis for policy decisions on how to reduce or limit the future growth of their concentrations”.

The report concludes that a doubling of CO₂ (or its equivalent) is likely to result in a temperature change in the range of 1.5 - 5.5 °C, noting that “the expected change of the global mean temperature due to a doubling of CO₂ is of about the same magnitude as the change of global temperature from the last glacial period to the present interglacial”.

Such temperature changes will have profound effects on global ecosystems, as well as agriculture, forests, and sea level rise could be 20 - 165 cm. However, data for the effect on agriculture and forests in different latitudes is lacking.

The scientific conclusions reached by this assessment were passed on to the participants in the 1985 International Conference on the Assessment of the Role of Carbon Dioxide and of other Greenhouse Gases in Climate Variations and Associated Impacts. Held in Villach, Austria, the conference was sponsored by UNEP, ICSU, and the WMO. The scientific executive summary was provided by the SCOPE report, mentioned above. The 89 conference participants were scientists from 29 developed and developing countries and the three sponsoring organizations. This group was to determine how to deal with the major uncertainties in existing knowledge, discuss “the nature of international collaboration and action that might be necessary now”, and elaborate research priorities. As the conference chairman, James Bruce, detailed the task of participants as follows: “to develop a consensus statement on the present state of our scientific knowledge of increases in CO₂ and other radiatively active gases, and the physical and socio-economic impacts, and to develop sound recommendations for action by countries and by international agencies, based on this scientific consensus” (WMO, 1986, p. 7)

James Bruce, the chair of the Villach conference, noted that one day was dedicated to scientific and technical presentations and debate concerning the scientific conclusions. He recalled that there was very little dissent among the participants; the SCOPE report was viewed to be the best assessment available at the time.

The report identified the conclusion that trace gases (CO₂, as well as nitrous oxide (N₂O), methane (CH₄), ozone (O₃), and chlorofluorocarbons (CFCs) are increasing, noting that gases other than CO₂ are already almost as important as CO₂. Under these conditions, the combined concentrations could be radiatively equivalent to a doubling of CO₂ from pre-industrial levels as early as 2030. This conclusion was the same as the SCOPE conclusion. The consequences of this doubling, they noted, would be an increase in the global mean equilibrium surface temperature of between 1.5 and 4.5 °C, an estimate which reduced the range cited by the SCOPE report by 1 degree at the upper end. The conference conclusion noted that regional divergence from the global average will exist. The conference estimated that this warming would lead to sea level rise of between 20 - 140 centimeters (25 cm less at the upper end than the SCOPE report), and that there is little doubt that the warming would have “profound effects on global ecosystems, agriculture, water resources and sea ice” (SCOPE, 1986, p. xxii). Unlike the SCOPE report, the conference did not state that the observed increase in temperature was attributable to increases in CO₂ and other greenhouse gases. Instead, they noted that the observed warming is consistent with that which would be predicted based upon the observed increase in CO₂ and other gases, “although it cannot be ascribed in a scientifically rigorous manner to these factors alone” (WMO, 1986, p. xxii).

The conference made some very general observations about the consequences of such a scientific understanding.^{iv} First, in a statement which many observers attribute to the conference chair Jim Bruce, they noted many important decisions are being taken by

governments which assume that past climatic data are a reliable guide to the future. This is no longer a good idea; the statement concluded, noting that there was a need for “refined estimates of future climate conditions to improve” decisions about water resources management, agriculture, coastal engineering, and energy planning. They suggested that the climate change issue was closely linked to other major environmental issues, particularly acid deposition and ozone depletion, and that the rate and degree of future warming “could be profoundly affected by governmental policies on energy conservation, use of fossil fuels, and the emission of some greenhouse gases”(WMO, 1986, p.1). The conference recommended that governments take the findings of the conference into account when developing policies, encouraged an increase in the dissemination of public information on greenhouse gases, made several recommendations for future research. It also called for WMO, UNEP and ICSU to establish a task force on greenhouse gases and to ensure that periodic scientific assessment is undertaken and that further mechanisms to encourage further national and international research and action were established. If deemed necessary, they concluded, these agencies should initiate consideration of a global convention.

With the details of the SCOPE and Villach 1985 consensus outlined, it is possible to compare these results to the results presented in prior assessments. Comparisons should be made on several dimensions. 1. Projected warming due to a doubling of CO₂, 2. Date by which this warming is expected to occur, 3. Relative contribution of CO₂ and other gases, and 4. the nature of the recommended response. A chapter in the SCOPE report does a great deal of this work, as one chapter consists of a synthesis of present knowledge, outlining the findings of previous assessments and contrasting them with the SCOPE study findings.

The striking result of this comparison is that the SCOPE report does not differ significantly from the reports which preceded it, particularly in terms of the scientific conclusions. The predicted range of temperature change appears to be very similar across reports, and over time. O’Riordan and Jaeger note that 1979 United States National Academy of Science report concluded that a doubling of the CO₂ concentration would lead to an increase of the average temperature of the earth’s surface of between 1.5. and 4.5 °C. Write Jaeger and O’Riordan, “up to and including the 1994 IPCC assessment, the scientific consensus was that there was no reason to widen or narrow this range” (1996, p. 14). In the 1979 “Charney Report”, the range was put at 1.5 - 4.5 °C as did the 1983 United States Environmental Protection Agency, and the 1981 Villach conference.

If anything, the SCOPE report (following the interim Villach conclusions of 1983) widened the range of uncertainty for such a warming, and projects a slower pace than the earlier Villach (1981) conclusions. The report estimated the temperature change due to a doubling of CO₂ and other greenhouse gases would likely be in the range of 1.5 - 5.5 °C. The projected date of doubling of CO₂ did not vary a great deal, as a low CO₂ emissions scenario would mean that “a doubling of CO₂ will be reached only after the year 2100” (SCOPE, 1986, p. 11). A middle range scenario put doubling near the end of the next century. The upper range scenario suggested doubling by about 2050. The authors noted that “[t]hese conclusions suggest a somewhat slower development than that discussed in

the first WMO/ICSU/UNEP assessment (World Climate Programme, 1981), and in the U.S. National Academy of Sciences study (CDAC, 1983)” (SCOPE, 1986, p. 11).

It should be noted that the SCOPE report was able to present its results on the basis of improved scientific methods. “The assessments shows an improved understanding of global carbon cycle in recent years” (SCOPE, 1986, p. 11). Advances in methods continued to confirm the same parameters for current and expected CO₂ (and other gas) concentrations, and expected temperature change, and results were reported with increasing confidence.

The report was not the first to note the importance of other greenhouse gases, although the report benefited from the appearance of an important 1985 paper by Ramanathan et al., which provided compelling evidence for the claim that other greenhouse gases could be as important as CO₂. For example, the 1983 National Research Council (NRC) report made a very compelling argument for the idea that CO₂ should not remain the sole focus of research efforts, nor, more importantly, the sole focus of the formulation of solutions. Indeed, the NRC group concluded that it might be easier to reach international agreement on other GHGs.

On the question of policy recommendations, the SCOPE report, together with the Villach conference, differed from prior assessments. It was the first to state that “substantial warming” would occur as a result of a doubling of CO₂, to note that increases in CO₂ “were attributable to human activities”, and to recommend a variety of specific policy actions. The NRC report, for example, concluded that scientific uncertainties concerning the projects of future CO₂ emissions were sufficiently great that no statements of the certainty of any future climatic changes, or the consequences thereof could or should be made. As such, they suggest further research, rather than quick policy action to address fossil fuel use.

The results of this comparison suggest that the substance of scientific conclusions *were not* significantly different from prior assessments. However, the *conclusions* that the scientists reached *based* upon the scientific analyses *were* significantly different. The Villach 1985 report made bolder statements about the implications of the scientific findings for policy making, and urged more significant steps toward international cooperation on the issue of climate change, calling for governments to recognize that future climate change could be stemmed by attention to policies concerning fossil fuel use, energy conservation, and greenhouse gas emissions. This stands in contrast to the conclusions reached just a few years earlier by the U.S. National Research Council as it advocated “caution not panic”, and weighed in against the development of policies to limit CO₂ emissions.

What Accounts for Villach’s Conclusions?

The first question that must be addressed concerns why this group reached different conclusions than those of its predecessors, taking the leap into the policy / political arena. This question may have several answers. The first concerns the institutional auspices

under which the assessment was carried out. The conjecture is that this independent group of international scientists, convened by UNEP, ICSU, and WMO were able to make recommendations that their colleagues involved in national assessments were unable to make, for political, or other, reasons. The second concerns the extent to which individual scientists, and the group as a whole, had come to the realization that it was time to act, or that there was an opportunity to act. This conclusion could be the result of a build up of years of considering the issue and the observation that scientific estimates consistently pointed to a human contribution to warming trends, or observations that the ozone negotiations were experiencing some success, and as such, other global environmental accords could follow.

The absence of domestic political constraints on the conclusions reached by this body cannot be underestimated as a source of leeway in reaching policy conclusions. The scientists attending the Villach conference attended in their personal capacities, not as representatives of their governments. They were selected by the three partner agencies. If they were selected by UNEP and WMO, they were likely to be government scientists, or scientists on contract to government. If selected by ICSU, they were mostly academic scientists. Although they came to the conference from 29 countries (both developed and developing), they were asked to “shed their national policy perspectives” and to address the global issues in as comprehensive a way as possible (Bruce, 1997).

The mandate handed to the group came from two intergovernmental organizations (UNEP and WMO) and a non-governmental organization (ICSU). As James Bruce noted, the call for policy recommendations was strongly made by the sponsoring agencies. Tolba urged the participants to recommend the establishment of an international coordinating committee on greenhouse gases, and to discuss in greater detail the options being placed before the world’s leaders, encouraging a “wider debate on such issues as the costs and benefits of a radical shift away from fossil fuel consumption” (WMO, 1986, p. 12). It was the hope of James Dooge, speaking on behalf of ICSU, that this conference would “provide a first approach to a sound foundation and appropriate guidelines for the development of the necessary policies at the national and international level” (WMO, 1986, p. 17). The WMO representative, Donald Smith, seemed the least activist of the three, urging a clear statement of current knowledge on changes in atmospheric changes and consequent effects for the use of policy makers, and guidance for future research to reduce uncertainties.

As a conference convened by these institutions, both intergovernmental and non-governmental, the approach was at the global level. The task was not to assess the climate problem with a view to understanding what subsequent policy action would be in the best interests of a particular country. Rather, the perspective was a global one. The question of whether the political climate or structure of interests within a particular nation would be amenable to making changes in fossil fuel consumption, or other greenhouse gas emissions. By definition, the conclusions reached by this conference were not accountable to national agencies, or legislative bodies that would be charged with implementing such conclusions. For example, the NRC report notes that its primary focus

was on CO₂, with a bit of attention paid to other greenhouse gases, for reasons having explicitly to do with the mandate and sponsor of the assessment. As Tom Schelling put it:

The protagonist of this study has been carbon dioxide. The research has been motivated by concern that atmospheric carbon dioxide is increasing and may increase faster as the use of fossil fuels continues to grow and by the known potential for a 'greenhouse effect' that could generate worldwide changes in climate. The group responsible for the report is the Carbon Dioxide Assessment Committee; the study was authorized by an act of Congress concerned with carbon-intensive fuels; and the agency principally charged with managing the research is the Department of Energy. The topic is usually referred to as 'the carbon dioxide problem,' a global challenge to the management of energy resources. (NRC, 1983, p. 450)

The Villach conference made recommendations that were in keeping not only with the goals of its organizational sponsors (continuing global climate research and policy advice for a global accord on the control of greenhouse gases), but that were in keeping with its perch in the international arena and consideration of the global commons.

Recalling that this same group of agencies convened a similar conference in 1980 may beg the question of why they reached one set of conclusions in 1980, and quite a different set in 1985. The conclusions of the 1980 conference were significantly more cautious, urging more research, rather than policy development. There are two factors which may help to illuminate why, in 1985, the group was not recommending only further research as the first priority of the global community; this international group was ready to engage the policy making community directly. The first concerns the scientists perceptions of how they should judge uncertainty, and in how they interpreted what these results (given existing uncertainty) meant for the scientists in terms of the risks that were present, and, ultimately, for how they should respond. The second concerns the opportunities that the international arena presented for the success of international environmental agreements. The two are interrelated.

In general, William Kellogg suggests "[s]cientists are trained to be cautious about jumping to conclusions too fast, and furthermore we will always be awed by the complexity of the planetary climate system and aware of our inability to understand all its interactions" (Kellogg, 1987, p. 122). As such, Kellogg concludes, scientists will be reluctant to make bold policy. Steve Schneider has suggested, in several venues, that making judgments about taking action is a value judgment, not a scientific one. In response to a question and remark by Senator Bradley in 1988 Senate Hearings, Schneider suggested the following:

Earlier he [Senator Bradley] was suggesting that the science may be sufficient to justify action. I just wanted to make very clear -- as a scientist, I have to do this and for my colleagues as well -- that whether we should take action, of course, is a value judgment about whether we fear more having the future descend on us with rapid change or whether we fear more investing present resources to hedge against that. In my value system, I believe in insurance. I am conservative in that

sense. I think a little insurance that, as Senator Wirth said, also has high leverage, makes good sense. But that, of course, is not a judgment that is scientific” (Schneider, 1989).

Schneider noted that policy choice moves beyond the realm of scientific expertise, into the realm of political values.

What urged these scientists to leave the realm of scientific judgment and enter the realm of political values, to, in the words of Kellogg, “stick their necks out”? The accounts of several scientists suggest that they finally realized that significant global warming could occur within their lifetime (or at least in the lifetimes of their children). The written record suggests that the addition of other greenhouse gases to the climate change calculus was an essential consideration for the participants of this conference. Tolba (UNEP) and Smith (WMO) mention the contribution of greenhouse gases as a factor which tipped the balance in favor of action to stem global climate change. Noted Tolba, “It is now estimated that by adding in the warming effect of other trace gases the equivalent of such a [CO₂] doubling may occur as early as 2030. Trace gases seem to be playing a much larger role in bringing about a greenhouse effect than was earlier expected” (WMO, 1986, p. 11). Donald Smith nearly dismissed the importance of further debate about carbon dioxide and global warming, noting that

the concept that increasing carbon dioxide in the atmosphere could lead to a global warming of the surface of the Earth has been known for some time. In fact, this topic has been a subject of scientific curiosity since 1863 when Tyndall first raised it. But society’s concern about the potential global consequences of the CO₂ increase has been much more recent. There is another concern for us today. Nearly 290 man-made chemical substances whose presence has been detected in the troposphere could, as their atmospheric concentration increases, add substantially to the warming trend expected from carbon dioxide (WMO, 1986, p. 13)

The written observations of Bert Bolin and Jill Jaeger suggest that the claim that other greenhouse gases could be as important as CO₂ in determining future climatic change, was critical in making a response to climate change urgent. Despite the publication of a paper in 1985 by Ramanathan (which Bolin viewed as significant), this conference was not the first time that this finding was presented. The claim had been present in both the scientific and assessment literature for several years. However, as Jim Bruce observed, the finding that greenhouse gases were the radiative equivalent of CO₂ made greenhouse gases “the biggest buzz of the conference” (Bruce, 1997).

The Villach gathering appears to have provided an opportunity for climate scientists to internationally acknowledge the importance of the scientific finding, and to discuss its significance with one another, and to convey the finding to a larger community of scientists with practical concerns. The importance that this group attached to this finding was reflected in one of the three general conference conclusions, in which the group noted that while some warming appears inevitable, the “rate and degree of future

warming could be profoundly affected by governmental policies on energy conservation, use of fossil fuels, and the emission of some greenhouse gases” (WMO, 1986, p. 1).

The first general conclusion of the conference suggests another source of initiatives to move the climate change issue from an academic arena to a policy one. The statement reads as follows:

Many important economic and social decisions are being made today on long-term projects...all based on the assumption that past climatic data, without modification, are a reliable guide to the future. This is no longer a good assumption since the increasing concentrations of greenhouse gases are expected to cause a significant warming of the global climate in the next century (WMO, 1986, p. 1).

It was arguably the dynamic created by this particular gathering of scientists that spurred them to recommend high level policy action on the climate change issue. The group gathered at Villach included not only those scientists who had been concerned with questions related to climate change, atmospheric chemistry, and meteorology, but those who were biologists and other natural scientists who had not been principally concerned with climate, as well as engineers. It was a group that was more inclined to consideration of the practical implications of scientific findings, by virtue of their capacities in government bureaus. These government scientists had not been deeply involved with climate science and were surprised by the findings, and the implications for the speed with which changes in climate change could occur. As Pier Vellinga, a sea coast engineer who joined the Villach process shortly after 1985 noted, the findings of Villach forced him to realize that even the lower bounds of climate change predictions would necessitate a transformation of his whole field.

Some evidence suggests that participants at Villach had been approached by policy relevant actors in their home countries. These actors, those responsible for hydropower planning, agricultural policy, or coastal engineering, were increasingly aware of evidence of global atmospheric change. Anecdotally, Steve Schneider notes that between 1979 and 1989 “news of global atmospheric change was moving up from the back pages of the science sections of newspapers and magazines, particularly when bad weather (like heat waves) struck”(Schneider, 1989), and business and other institutions were increasingly discussing climate issues. Jim Bruce, who was the Assistant Deputy Minister for the Atmospheric Environment Service in Canada at the time of Villach, was approached by a representative of the government of the province of Alberta. The official wanted to know if they were “throwing good money after bad” when they bailed out drought stricken farms, asking whether the area was simply going to be a dry area in the future. According to Bruce, the group as a whole came to the conclusion that a lot of decisions were being made world wide that rested on assumptions about a stable climate, or a future climate that was like the past climate. This spurred the group to strongly urge careful consideration of current scientific findings in the development of government policy, and to suggest that efforts should be made at the international level to reach agreement about the emission of greenhouse gases.

These dynamics meant that the climate change issue became more urgent for this group. The finding focusing on other greenhouse gases was new to non climate scientists, and merited attention. The climate scientists used this to motivate their new call for urgent action, as this calculation meant that significant change could occur as early as 2030. Once the calculations included CO₂ AND other greenhouse gases, Jaeger recalled, it was clear that significant changes in global temperature were projected to occur within 30 - 50 years, rather than late in the next century. This she noted, meant that climate change was a problem for the current generation, not one that could wait to be addressed. Bert Bolin, in an account of the SCOPE report, echoed Jaeger's sense of the importance of the addition of greenhouse gases:

An important paper by Ramanathan et al. became available towards the end of the assessment, in which the role of other greenhouse gases in enhancing the greenhouse effect was pointed out. These other gases proved to be as important as CO₂. Suddenly, the climate change issue became much more urgent. The radiative forcing of the atmosphere, corresponding to a doubling of the CO₂ concentration, was anticipated by about 2030 rather than during the latter part of next century (Bolin, 1986, p. 26).

Jill Jaeger describes the effect on the group of scientists at Villach as a sort of “a ha”, or “wow, significant change could take place in our lifetimes. While evidence for the importance of greenhouse gases had been mounting between 1980 and 1985, this group of scientists mobilized around the finding and used it to justify a call for urgent action.

In addition to catalyzing a new group of actors around the idea that the climate issue needed to move from the scientific arena to the policy arena, the Villach conference also featured a reversal of opinion for Thomas Malone, the chair of the 1983 NRC report, who, in 1984 testified before Congress about the need for “caution not panic”, elaborating the uncertainties in climate science.^v In concluding remarks to the conference, Malone noted that “as a reversal of a position I held a year or so ago, I believe it is timely to start on the long, tedious and sensitive task of framing a CONVENTION on greenhouse gases, climate change, and energy”(WMO, 1986, p. 33).

The reasons for Malone's reversal suggest that another reason for the policy conclusions of the group. In a reflection on the previous decade of discussion on the climate change issue, Thomas Malone (who participated in a 1975 WMO Panel on Climate for the WMO Executive Committee), noted that the most important development of the last decade was “the finding that increases in the ‘other’ greenhouse gases...have contributed about one half of any equilibrium temperature change that might be ascribed to the increase in CO₂” (WMO, 1986). He calls the finding a “surprise”, significant because it meant that the date of potentially serious environmental consequences was several decades earlier than had been previously anticipated”. However, careful readers will recall that Malone's report did include other greenhouse gases in their analysis, yet they advocated caution. For Malone, and perhaps for others, there is more to the story of the decision for action. Malone cites several other developments of the latest decade, including improvements in climate models, as well as attention to the impact of climate change on ecosystems.

However, he ultimately noted that a decision to initiate contact between scientists and policy makers was a timely one. He concluded that there had been a growing perception that there was a wide range of human activities which could “produce changes on a global scale”. The ozone agreement, he suggested, was indicative of this change in perception. This stands in stark contrast to the conclusion that the NRC report reached about the likelihood of achieving international agreement on climate change (let alone the prospects of getting parties to the table). In 1983, the NRC Report concluded that

Given the need for widespread, long-term commitment, a CO₂ control strategy could only work if major nations successfully negotiated a global policy. While such an outcome is possible, there are few examples where a multinational environmental pact has succeeded, the nuclear test ban treaty being the most prominent. Other clearly recognized problems --whale fisheries, acid rain, undersea mining, the ozone layer -- emphasize how time on the order of decades is required to achieve even modest progress on international management strategies. (NRC, 1983, p. 70)

The report went on to note that the participation of the Soviet Union would be essential, and that it was hard to see why the Soviet Union would even participate.

The successful negotiation of an ozone convention, as reflected in Malone’s remarks, is yet another reason that the policy mandate and the emphasis on other greenhouse gases and the move to policy recommendations made sense for this group. By March of 1985 the Vienna Convention for the Protection of the Ozone Layer had been adopted. UNEP, and Tolba in particular, were encouraged by their success in negotiating the ozone agreement, and had determined that a convention on climate change could be their next endeavor. Peter Usher, a major representative of UNEP in the ozone negotiations, notes that as a result of the success of negotiating the Vienna Convention, UNEP had found a niche as a broker of conventions, and it was a role that UNEP wanted to continue. Tolba and the scientists involved in the Villach meetings saw a window of opportunity, through which they could push climate change. Like Malone, they viewed the ozone agreement as a breakthrough in the treatment of global environmental issues.

Most, if not all, of those who made formal statements to the Villach gathering mentioned the connections that needed to be drawn between climate change and other environmental issues, particularly ozone depletion. James Bruce’s remarks emphasized the connections between acid rain, ozone depletion and climate change. William Clark’s account of the practical implications of increasing greenhouse gas emissions noted that the problem of greenhouse gases was “intimately linked to other problems”. The general thrust of the remarks was that tackling one global atmospheric issue necessitated consideration of a spate of others.

Was Villach Important?

There is little evidence to support the claim that the Villach conference marked a change in scientific consensus. The basic predictions of warming due to a doubling of CO₂ or its

equivalent and the range of decades in which doubling could be expected to occur were roughly consistent between 1981 and 1985, and those who disagreed still disagreed in 1985. However, a change did seem to occur in the conclusions, or policy judgments, that were reached based upon the scientific findings. In addition, the group did focus some additional attention on the role of other greenhouse gases. The group concluded that policies on energy, the use of fossil fuels, and emission of greenhouse gases could strongly affect the rate and degree of future warming. Explanations for this shift rest largely on the nature of the scientific community that was created at the meeting, and by the timely and advantageous connections to ozone.

The next question concerns the effect that these changes had on the position of climate change on several international agendas. What was done with, or as a result of the conclusions of Villach? It is clear that climate change was well established on the agenda of international groups of scientists, a position which was solidified by the Villach 1985 gathering. What evidence is there that the Villach findings affected changes in the agendas of international specialized agencies, the United Nations general assembly, national politics, the media, or the public? What paths to these agendas from the Villach findings can be identified? How were the findings diffused? Which of the uses or paths of diffusion were due to the policy recommendations of the group, the attention to other greenhouse gases, or to the fact that the assessment and conference were conducted by international organizations? How much was due to the aforementioned ozone agreement, or other factors?

The diffusion of the Villach conclusions can be traced down several paths to several agendas. First, national governments, particularly the United States, took notice. Second, the sponsoring organizations took on additional action, as did the United Nations General Assembly. Third, the participating scientists pursued further connections to policy. Fourth, independent international conferences drew on the Villach findings. In general, it is not clear that the intensified focus on other greenhouse gases figured into subsequent debate and discussion. As the diffusion of Villach's conclusions unfolds, the focus remains almost exclusively on CO₂ and fossil fuel reduction. There is no evidence that new groups of actors emerged to press the climate change issue onto the agenda as a result of the fact that other greenhouse gases were considered to be as important as CO₂. For example, subsequent debates did not feature coalitions of cattle ranchers or rice paddy farmers. The substance of this finding wasn't as important as the fact that it provided a justification for the urgency of action.

At the time of the Villach conference, the group did not engage in efforts to distribute its conclusions. Despite the fact that the conference recommended an increase in public information efforts on issues related to climate change, including the wide distribution of the documents of this conference, such efforts were not made by the leadership of the conference.

National Agendas

The report received a more attention in the United States than it otherwise might have on account of the disagreement that the Department of Energy officials had with it. They returned to the U.S. and quite loudly complained about the conclusions, suggesting that the Villach group was not representative enough to be dictating the terms of international action.

Indeed, the conclusions of the Villach conference, the subsequent creation of the Advisory Group on Greenhouse Gases, and increasing attention to policy recommendations through the Villach and Bellagio gatherings of 1987, led some governments to conclude that these actions were too far outside the realm of government control to be desirable. According to Peter Usher, governments distrusted the subsequent Advisory Group on Greenhouse Gases, suggesting that it was not broad based enough, and that they preferred an international forum which featured their own government scientists in international negotiations. This outcome suggests that some of the attention that Villach received stemmed from the fact that it had successfully approached the problem from a global perspective, without regard to the interests of particular nations.

This perception was especially prevalent in the United States, although the American story is a slightly complicated one. Within the United States there was interagency conflict over the negotiation of a convention. The Department of Energy “felt strongly that the Villach report was inadequate because it was not prepared by government officials” (Hecht and Tirpak, 1995, p. 381), while the Environmental Protection Agency and the Department of State supported the idea. Debate and a resulting compromise led the U.S. to support the intergovernmental panel on climate change. The details of this process are highlighted by Shardul Agrawala (1997) in his account of the creation of the IPCC, but the essential feature was that the panel would be constituted of nationally nominated scientists.

Jill Jaeger’s account of climate science and politics in (then West) Germany emphasizes connections between international developments and domestic attention (Jaeger, 1997; Bares et al., 1998). German climatologist Egon Degens attended the Villach 1985 conference. He was subsequently involved in discussions of the importance of the climate change issue, particularly with the German Physical Society (DPG), which had been examining the climate change issue since the early 1980s. A November 1985 report by the DPG is credited with bringing the climate change issue to the attention of many Germans.

The report, “Warnung vor einer drohenden Klimakatastrophe” (“Warning of a threatening climate catastrophe”) “...predicted an apocalyptic ‘climate catastrophe’ due to fossil-fuel combustion and deforestation. Press coverage of the report featured scenes of cracked, dry earth and the Cologne Cathedral deluged by the North Sea” (Bares et al., 1998, p. 14). The report was picked up by the media in a January 1986 press conference and was widely disseminated, driving the agenda for climate policy in Germany. The Enquete Commission on Preventive Measures for Protection of the Earth’s Atmosphere published its first interim report in 1988. Recommendations that climate change was a

serious threat which warranted preventive action immediately was addressed and approved by the West German Bundestag.

The United Nations Agenda

According to James Bruce, the conference report was used principally as an internal document by WMO and UNEP, and was not used as part of a public information (or government information) campaign. As such, the conclusions were used to develop the agenda of climate change within the United Nations specialized agencies. The recommendation of the Villach conference (and the wish of Mostafa Tolba) was fulfilled through the creation of the Advisory Group on Greenhouse Gases (AGGG) which was intended to further science and policy, and make recommendations on the development of a climate convention. This group did meet after Villach, in July 1986. The experts were nominated (two each) by UNEP, WMO, and ICSU. The AGGG approved a plan for a conference to be organized under its auspices. The work of the conference is detailed in the section concerned the agenda of scientists. Based upon the conclusions of that conference, the AGGG adopted a work plan for itself in 1988; the results of the work was published in four volumes in 1990. This work is beyond the purview of the study (see rather Agrawala, 1997).

The Villach conclusions coincided not only with increasing attention in the UNEP and WMO, but also in the United Nations General Assembly. In 1982, a special session of UNEP's Governing Council was held to review progress since the Stockholm Conference of 1972. The Council concluded that more long-term environmental planning was needed. The World Commission on Environment and Development (WCED) was created in UN General Assembly resolution 38/161 in the 38th Session of the United Nations in 1983, and chaired by Gro Harlem Brundtland, then leader of the Norwegian Labour Party. The so-called Brundtland Commission was charged to

re-examine the critical environment and development issues and to formulate realistic proposals for dealing with them; to propose new forms of international co-operation on these issues that will influence policies and events in the direction of needed changes; and to raise the levels of understanding and commitment to action of individuals, voluntary organizations, businesses, institutes, and governments (WCED, 1987, p. 4)

The report analyzed a wide range of environment and development issues, and recommended the creation of a UN Programme on Sustainable Development and, later, an international conference to review progress on these issues. The report is often accorded a great deal of credit for the development of international environmental policy.

Among the issues which demanded attention were issues of particular concern to developing countries (desertification, deforestation, pollution, and poverty induced by environmental degradation) and industrialized countries (toxic chemicals and wastes and acidification). All nations, the report notes, face suffering caused by "releases by industrialized countries of carbon dioxide and of gases that react with the ozone layer,

and from any future war fought with the nuclear arsenals controlled by those nations” (WCED, 1987, p. 22). The Commission report consulted with thousands of individuals from around the world, heard hours of testimony in public hearings, and read numerous submissions.

Rather than mounting a more extensive analysis of the effect of the Brundtland Commission report on the development and framing of a wide variety of environmental issues, in addition to the initiation of the United Nations Conference on Environment and Development (UNCED), it is important to note the relevance of the report to the more narrowly focused story of climate change. Beyond a general emphasis on global atmospheric problems, the report’s account of the problem of climate change draws almost exclusively on the Villach conference findings. Several paragraphs of conclusions paraphrase and cite the Villach 1985 text. While the Brundtland Report notes that, based on the scientific evidence, particularly in light many complexities and uncertainties, “it is urgent that the process [of taking action]start now” (1987, p. 176).

Gordon Goodman, key Villach participant, and member of the AGGG, was directly involved in the work of the Brundtland Commission. He served as part of a “Group of Special Advisers” on Energy; several observers of climate science credit him with drafting the sections of the report concerned with climate change (Bolin, 1997; Jaeger, 1997; Clark, 1997). There is no evidence that any of the individuals with primary responsibility for the SCOPE 29 report or the Villach conference communicated in verbal or written form with the Commission. Michael Oppenheimer and George Woodwell, who, together with Goodman initiated the subsequent Villach / Bellagio 1987 meetings (discussed below), are often credited with the dissemination of the urgency of the problem of climate change do not appear to have had direct contact with the Commission.^{vi} However, indirect consultations between government representatives and others who testified and those who contributed to the Villach conclusions is likely, but no direct trail is apparent.

The fact that the Villach report was mentioned in the Brundtland Commission, and shaped its recommendations (in fact, constituted its recommendations) on action to protect the earth’s climate, meant that the Villach message enjoyed wide dissemination. The Commission and its report enjoyed a high profile, and consequently, served to raise the profile of a number of environmental issues in the global arena. The report was reprinted six times in 1987, three times in 1988, and three times in 1989. A revised edition was published in 1988. The presentation of the report’s findings to the General Assembly in 1987 provoked a significant discussion about climate change, featuring a intervention by the representative from the Maldives which helped to bring the issue of climate change into the forefront. Moreover, as noted above, the recommendations of the Brundtland Report informed the action of the UN General Assembly in planning further attention to the problems of the global environment.

The Brundtland Commission report and the Villach conclusions came together in another venue as well. The Canadian Atmospheric Environment Service (AES) and the Canadian Government had an interest in establishing a leadership position for Canada on global

environmental issues. The AES used the public hearings of Brundtland to offer to host a major international conference on the global atmosphere. Canada's Minister of the Environment, Tom McMillan, offered to host such a conference in May 1986, in a statement during public hearings held by the Brundtland Commission. Climate change was proposed to be the first topic considered.

The Conference was timed to occur after the release of the WCED Report "Our Common Future", which issued a call for gatherings of its kind. Gro Harlem Brundtland was invited to give the keynote address. By February of 1987, the planning group had determined that the results of the Villach / Bellagio meetings later in 1987 would feed into their conference. The Canadian Atmospheric Environment Service had a direct connection to the Villach process through Jim Bruce, the chair of the Villach 1985 meeting. Bruce and Howard Ferguson, Conference Director for the Toronto Conference and Assistant Deputy Minister of the Atmospheric Environment Service, both attended the Bellagio meeting.

Scientists' Agenda and Initiatives

Prior to a discussion of the development of the Toronto Conference, the 1987 Villach / Bellagio conferences merit attention. The above international initiatives were more or less disconnected from direct advocacy on the part of Villach 1985 scientists. They had largely to do with the nature of its sponsors, the international composition of the gathering, and the strident nature of its conclusions. The 1987 Villach / Bellagio meetings, however, were a pathway of conclusion diffusion that was orchestrated directly by the scientists. The first meeting of the AGGG provided an opportunity for the activist scientists to begin an initiative to pursue further links to policy.

At the first meeting of the AGGG, discussions at that meeting led one member of the AGGG, Professor Gordon Goodman, of the Beijer Institute, proposed to organize a set of workshops designed to address questions of policy response to climate change. (Jaeger, 1990). He was joined by two other scientists concerned with climate, Michael Oppenheimer of the Environmental Defense Fund, and George Woodwell of the Woods Hole Research Center. These workshops were intended to further the process of policy development begun in 1985. They were joined in workshop planning by a steering committee which included Bert Bolin (Sweden, International Meteorological Institute), William Clark (USA, Harvard University), W. Degefu (Ethiopia, National Meteorological Services Agency), Howard Ferguson (Canada, Atmospheric Environment Service), F.K. Hare (Canada, University of Toronto), Jill Jaeger (West Germany and the Stockholm Environment Institute), and C.C. Wallen (Kenya, United Nations Environment Programme).

The workshops were conducted under the auspices of the AGGG and the results fed into further AGGG efforts, particularly a report issued in 1990. The first workshop was held from 28 September to 2 October 1987, again in Villach, Austria. This meeting explored the implications of increases in greenhouse gas concentrations in the atmosphere for various regions of the world. Papers were contributed by twenty scientists, economists,

and policy experts. The papers were peer reviewed only after the conference, and eventually published in *Climatic Change* in 1989. Fifty scientists and technical experts from eleven countries attended the conference in Villach. A policy workshop was held in Bellagio, Italy in November, where the steering committee members were joined by fourteen others, including representatives from UNEP, the meteorological services of New Zealand, environment bureaus of the United States, the Netherlands, the European Union, the cabinet offices of Sweden and Germany, a member of the Commonwealth Secretariat in England, and several NGOs. This conference emphasized that the scientific consensus reached at the Villach 1985 conference, and the conclusions reached at the Villach meeting were used as a starting point for both of the 1987 workshops. The basic conclusions of the workshop differed very little from those of Villach 1985.

According to Michael Oppenheimer, one of the organizers of the 1987 meetings, “[t]he sponsors of the Villach and Bellagio workshops in 1987 hoped to provide a bridge between the 1985 Villach conference, which found that the issue of climatic change merited the attention of policy makers, and the actual elaboration of specific measures to limit or adapt to warming” (Oppenheimer, 1989). A document based on the discussion was edited by Jill Jaeger. The group advocated the “use of long-term environmental targets, such as the rate of temperature change or sea-level change, would be extremely advantageous as a management tool” (World Climate Programme, 1988, p. 21). Such targets, they suggest, “would be based on historic rates of change of temperature or sea level, and on expected consequences for ecosystems and society”. Given such a rate of change, a translation into emissions targets could be made. The group identified a goal of keeping the rate of temperature increase below 0.1 °C per decade, based primarily on the rate of ecological adaptation, which originated with a group of scientists concerned with the rate at which particular species of trees could migrate. Data about that ability of countries to cope with the effects of sea level rise were used to bolster these findings. The conference involved, for example, Pier Vellinga, a coastal engineer from the Netherlands, who provided expertise from the Dutch experience in managing sea-level rise. The conference included papers which gave consideration to ecological adaptation.

The temperature change scenarios adopted by the group took the reductions of CFC production required by 2010 into account. To achieve a target of 0.2 °C per decade (under a scenario for middle latitude locations), the group concludes that emissions of non-CO₂ gases would have to be reduced by 50 - 66%, which, they conclude, could be achieved using current technology. To reach the 0.1 °C per decade target, the rate of CO₂ emissions could have to be reduced by up to 66%. The group suggested that there were five possible ways to achieve such CO₂ reductions. Three of these options focused on the reduction of fossil fuel use through a variety of methods (energy efficiency, alternative energy, switch to low CO₂ emitting fuels), while the other two relate to a reversal of the current deforestation trend and the disposal of CO₂ in the deep ocean. However, the goal of 0.1 °C per decade could only be achieved “with significant reductions in fossil fuel use” (World Climate Programme, 1988, p. 24, emphasis in original). This channel of development of policy was notable for the absence of a considerable focus on non-CO₂ gases. They were nearly dismissed as easy to handle and the report returned to a focus on

CO₂ and energy policy. However, the work of this group was notable for its focus on targets and timetables. Several participants noted that this shift in focus was calculated to provide not only relevant policy information, but to derive yardsticks for government action. It represented an attempt to transform scientific facts into political facts^{vii}. The group at Villach / Bellagio sought to answer the question: what can be tolerated by ecosystems and society?

This group reflected carefully on the uncertainties that faced both climate scientists and policy makers in evaluating the effects of greenhouse gases and climatic changes. However, they, like Steve Schneider, judged that “[i]f decision-makers were to wait until the scientific uncertainty is ‘acceptably’ small, most policy responses would be too late” (Schneider, 1988, p. 32). They conclude that “a coordinated international response seems inevitable and rapid movement towards it is urged” (World Climate Programme, 1988, p. 37, emphasis in the original). The group advocated the prompt approval and ratification of the ozone protocol, examination of national energy policies, consideration of the issue of deforestation, evaluation of non-CO₂ greenhouse gases and limitation of the growth of their concentrations in the atmosphere, careful consideration of policies to manage sea-level rise, and continued scientific research. The group concluded that the report should be used by the AGGG to further scientific and policy research, and to inform the discussion about the development of an international agreement on climate change. The report was presented to the AGGG in late 1987, and the AGGG formed three working groups.

Michael Oppenheimer noted that the group that contributed to the 1987 conferences felt that “their effort have born unusual fruit, and not fallen into the ‘black hole’ that often swallows workshop outcomes”, for the reason that the Bellagio Report “provided a basis for the recommendations of the June 1988 Toronto meeting, ‘The Changing Atmosphere’” (Oppenheimer, 1989, p. 3). Given the claim that the major success of this group’s work was the fact that it informed the Toronto Conference, the way in which the conclusions which pushed in the direction of targets and timetables informed the Toronto process merits attention.

The Toronto Conference: A climate agenda for national delegates, the media, and the public

The Toronto Conference, convened in June 1987, brought together 341 delegates, including 20 politicians and ambassadors, 118 policy and legal advisors and senior government officials; 73 physical scientists, 50 industry representatives and energy specialists; 30 social scientists and 50 environmental activists. Attendees came from 46 countries, both developed and developing. Fifteen agencies of 24 international organizations were represented. The opening of the conference featured government officials and scientists; participants were divided into thematic working groups^{viii} to fashion contributions to the conclusions and recommendations of the conference. The conclusions of the Villach process informed the conference through a background paper, written by Jill Jaeger, who edited accounts of both the 1985 Villach and 1987 Villach /

Bellagio conferences. It was intended to provide a common point of departure for conference participants. The conference organizers brought working group chairs to Toronto in advance in order to do briefing sessions based upon this background document. The document reiterated many, if not most, of the arguments put forward by the Villach groups concerning the seriousness of the climate problem and the urgency of action. Recommendations for policy action echoed the Villach / Bellagio 1987 conclusions. The background paper advocated the development of a law of the atmosphere, which could “incorporate and build on other conventions and protocols such as the 1987 Montreal Protocol” (WMO, 1989, p. 401).

When the Villach group was tapped for a contribution to the Toronto Conference in early 1987, neither that group nor the Toronto Conference planners could have foreseen the high profile that the Toronto Conference would enjoy in June 1988. By 1988, the climate change issue had moved from scientific circles and specialized agencies of the United Nations to the UN General Assembly, and to the government and legislative offices of a number of countries. What happened in the summer of 1988 was an identifiable leap to the public arena, the highest levels of national governments, and the international agenda beyond the United Nations. In an editorial reflecting on what transpired during the summer of 1988, Stephen Schneider noted that “it was with some pleasure that I observed this viewpoint [that climatic changes could be significant in the middle of the next century] passing from the ivy-covered halls of academe and the concrete and glass of government offices into the popular consciousness” (Schneider, 1988).

By the time the Toronto Conference was convened in June of 1988, a serious heat wave had occurred in the United States, and the media, accustomed to using “weather hooks”^x to write about climate change, had provided extensive coverage of the extreme weather and to its connections to climate change. The story is a familiar one. It links these extreme weather events, testimony by James Hansen of NASA before the Senate to tremendous media and public attention to the issue of climate change. The June heat wave was just the beginning. The summer to be one of the hottest on record, and droughts would occur in many places in the United States. However, the June heat wave was enough to bring considerable attention to the Toronto Conference. Notes Steve Schneider, “[a]n international gathering in Toronto at the end of June attracted so many reporters that extra press rooms had to be added to handle the hordes of descending journalists” (Schneider, 1989, p. 194). International media attention to the problem of climate change began a steep rise in 1987-1988, peaking in 1990 (see data in the Social Learning Group, 1998).

Ultimately, rather than driving the discussion about the science of climate change, many climate scientists were being driven by it. Lamented Steve Schneider in a 1989 editorial reflection on the summer of 1988:

By July 1988, there were cover stories in news weeklies, lead articles on broadcast news programs, and hundreds of newspaper and magazine write-ups appearing on the presumed connection between the heat wave and the greenhouse

effect. With a few exceptions, there was very little scientific content in most of the stories..." (Schneider, 1989).

Schneider, and other climate scientists, were faced with the need to make responsible statements about the science of climate change, while also lauding the development of public interest in the potentially harmful effects of future climatic change. The outcome of the Toronto Conference represented intersection of these concerns.

The Toronto Conference was a critical moment in the development of an international political agenda on climate change. The international work of scientists met a growing public demand for information. The effect of this nexus was to make it difficult for national leaders to avoid the issue. The Villach 1985 group and several other international bodies brought a high degree of concern for the problem, Villach / Bellagio group brought its new focus on targets and timetables to the conference, the outcome of the conference was closely watched by an international media and the public. The outcome was used by non-governmental organizations, and leader countries on climate change to press the issue onto the political agenda.

The conclusions of the Toronto Conference are quite well known: "The Conference urges immediate action...to counter the ongoing degradation of the atmosphere...An Action Plan for the Protection of the Atmosphere needs to be developed, which includes an international framework convention, encourages other standard-setting agreements and national legislation to provide for the protection of the global atmosphere" (WMO, 1989, p. 296). The mostly widely cited conclusion of the conference was the need to "reduce CO₂ emissions by approximately 20% of 1988 levels by the year 2005 as an initial global goal" (p. 296). The 20% figure is still used as a benchmark by environmental non-governmental organizations (NGOs) and some nations.

The contribution of science to this outcome and target was minimal. While the background paper provided by the Villach / Bellagio group contained an ample summary of the state of scientific knowledge, as well as scientific assessments of the necessary target for CO₂ emissions to achieve a "tolerable" rate of climate change over each decade, the conclusions of Toronto did not bear any resemblance to these conclusions. Recall that the Villach / Bellagio group suggested that a 0.1 °C per decade temperature change would necessitate not only a 20 - 50% reduction in non-CO₂ greenhouse gases, but also a 66% reduction in CO₂ emissions. The Toronto target fell far short of this level. However, the idea presented by Villach / Bellagio that targets and timetables were a way to push the policy debate forward was diffused.

Representatives of the scientific, policy, and NGO community identify the 20% target as the significant accomplishment of the Toronto Conference (Bruce, 1997; Boyle, 1997; Usher, 1997; Vellinga, 1997). The Villach / Bellagio group went began a discussion of target and timetables from a scientific perspective. At Toronto, political considerations contributed. Accounts of the origins of the 20% target disagree in some respects. Some suggest that the target was an NGO initiative which was successfully imposed upon a conference that had been effectively hijacked by NGOs (Boyle, 1997; Moomaw, 1992). Some suggest that NGOs put pressure on the working groups to adopt the

recommendation. Others, however, suggest that the target was a conclusion of the energy working group, led by some advocates of renewable energy. The group was led by Jose Goldemberg, an advocate of energy efficiency and renewable energy, and included W. Haefele, an advocate of alternative energy (nuclear). Together, Goldemberg and Haefele, together with the rest of the group, calculated that a 10% reduction in emissions could be achieved through improvements in energy efficiency, and that a 10% reduction could be achieved by transforming the source of supply of energy to renewable sources that “deliver energy without carbon dioxide” (WMO, 1989, p. 320). Others have suggested that the 20% figure was simply one which seemed to be a compromise between the 60% figure that the scientific assessment had presented, but which was politically impossible, and the desire on the part of some nations to do nearly nothing.

The actual source of the figure was probably some combination of energy committee suggestions and the initiatives of NGOs. However, it should be noted that the mobilization of NGOs was in the early stages at this point in the development of the climate issue. A few NGO representatives, including the scientific Beijer Institute, had participated in the Villach assessment process. However, they were largely acting as scientists, rather than as representatives of their organizations (e.g. Michael Oppenheimer, Irving Mintzer). It was these same individuals who were active in 1988. In general, organizations had not made climate change an organizational priority. However, many who participated in the Toronto meetings noted the presence of the NGOs and remarked on their ability to use the media to express their views.

However, Toronto served to bring the climate change issue to the attention of NGOs as organizations, and to the forefront of organization agendas. Climate change was a difficult issue for NGOs, as they ran campaigns around very simple themes: pollution, energy, etc. Climate change did not fit neatly into any of these categories, and further, the emphasis on alternative energy put the climate change issue into conflict with the anti-nuclear campaigns of several of the major NGOs. It took some time for the NGOs to find a place for climate change on their agendas, and to reconcile support of CO₂ emission reductions with their anti-nuclear campaigns. However, several representatives of NGOs attended the conference, and seized the opportunity to organize themselves. The idea for the Climate Action Network grew out of discussions between NGO representatives at the conference, and as climate change moved onto the political agenda, NGOs organized themselves to address it.

The 20% target was a compelling target, and subsequent declarations and conferences have emphasized it. The Toronto Conference was essential to the generation of momentum towards a response to the problem of climate change. From Toronto, climate change was a feature of a large number of international conferences (Noordwijk, the Hague, the Group of Seven Economic Summit), and environment issues in general enjoyed a high profile.

Conclusion

The Toronto Conference does not mark the end of the climate story. Despite calls for action to respond to the threat of climate change, the negotiation of a convention was not initiated until 1990, and the signatories to the resulting Framework Convention on Climate Change have yet to make substantial commitments to reductions in greenhouse gases.

However, by 1988 - 1989, climate change was undoubtedly an issue that received considerable attention from the nations of the world. Agreement about the need for action on climate change was so significant that the declaration of a representative of the Soviet Union at a 1988 conference that some countries could benefit from climate change was received like "swearing in the church" (McGourty, 1988, p. 194). This high level of international attention came as a surprise to many of those involved with the climate change issue. From his perch in 1987, William Kellogg lamented that despite considerable increases in scientific knowledge and the emergence of a scientific consensus that increases in atmospheric concentrations of CO₂ are warming the earth and that humans are to blame, "we have yet to see an important governmental or industrial decision that actually acknowledged the climate change factor." Nor have measures been taken to mitigate the adverse effects of climate change. Kellogg concludes that "there are a number of reasons for thinking that the nations of the world would not unite to prevent the impending climate change" (Kellogg, 1987, p. 25).

Kellogg was not the only observer who thought that the likelihood of international cooperation to prevent climate change. Tom Schelling, an astute observer of global strategy, noted in 1983 that

In the current state of affairs the likelihood is negligible that the three great possessors of the world's known coal reserves -- the Soviet Union, the People's Republic of China, and the United States of America -- will consort on an equitable and durable program for restricting the use of fossil fuels through the coming century and successfully negotiate it with the world's producers of petroleum and with the fuel-importing countries, developed and developing (NRC, 1983, p. 481).

However, within several months of the publication of Kellogg's article, new development suggested that serious efforts would be made to reach international agreements on measures to protect the climate. Scientific concern had translated into myriad international declarations and movement toward policy action.

This paper represents one approach to understanding the links between science and policy, and to understanding why observers like Kellogg and Schelling found climate change on the international agenda by the end of the 1980s. This study detailed the conclusions of the Villach 1985 conference and analyzed the pathways and form of the diffusion of those conclusions into the international policy making community. The period from 1983-1988 was relatively rich in attention to environmental issues. Many initiatives were occurring on a number of agendas (science, legislative, national, UN).

The story is complex, and many factors were pushing in the direction of attention to a number of environmental issues. However, this paper makes the case that the assessments conducted in during this time by UNEP, WMO and ICSU made political judgments about scientific facts which resonated with other initiatives on the environment. Several scientists pursued the issue in a variety of venues, and helped to shape the language that was used to talk about climate change and to motivate the development of an international agenda on climate change. The conclusions of the Villach conference helped to draw the attention of the nations and individuals who continue to pursue negotiated solutions to the climate change problem today.

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Endnotes

ⁱ For comments on an earlier draft of this paper the author thanks William C. Clark, Jill Jaeger, Robert O. Keohane, Edward Parson and Stephen Schneider. This paper has benefited from discussions with participants in the Global Environmental Assessment project, as well as participants in climate assessments and climate politics. The author would like to thank James Bruce, Stewart Boyle, Bill Clark, Jill Jaeger, John Lanchbery, Peter Usher, and Pier Vellinga for sharing their insights and experiences. Shardul Agrawala and Clark Miller engaged in many useful discussions with the author, and Nancy Dickson generously shared her research materials on climate change. The International Institute for Applied Systems Analysis (IIASA) in Vienna was an ideal place to study and work; Jill Jaeger and Ingrid Tepy-Baubinder, together with the IIASA librarians, were superb hosts. The Belfer Center for Science and International Affairs likewise provided a terrific work environment. The author acknowledges support from the Global Environmental Assessment project and the Institute for the Study of World Politics. Any shortcomings in the rendering of events are the responsibility of the author.

ⁱⁱ Acknowledgments to John Holdren for articulating this definition so well during a group conference call.

ⁱⁱⁱ It should be noted that some theorists have pointed out that scientific consensus is not as useful a predictor of international cooperation (or the absence of political bargaining) as the observations above may suggest (see for example, Parson 1993; Litfin, 1994). However, the argument about scientific consensus is pursued here because many observers have suggested the Villach conclusions were significant because they represented scientific consensus. The goal here is to determine the extent of the strength of the claim in this case.

^{iv} The largest opposition to conference statements came from U.S. Department of Energy participants, who wanted the statement to be watered down. The scientific uncertainties, they argued, were still too great. Conference observers that were interviewed disagreed about the extent to which these officials verbally disagreed while at Villach. However, it is clear that their dissent was critical to the dissemination of the Villach findings, which will be discussed later.

^v I am grateful to Clark Miller for bringing Malone's participation in the 1983 study and congressional testimony to my attention.

^{vi} This conclusion is based on a list of contributors to hearings, communications, reports for the Commission, (World Commission on Environment and Development, 1987, p. 366- 387). None of the following people or organizations appear: Villach: the Chair (Jim Bruce) or Co-Chairs (G.S. Golitsyn, R. Herrera, J. Rasmussen); Primary editors of the SCOPE 29 report (B. Bolin, B. Doos, R. Warrick, J. Jaeger); The Advisory Group on Greenhouse Gases or its members; Michael Oppenheimer and George Woodwell.

^{vii} Klaus Meyer-Abich (1980) elaborates on the idea of scientific and political facts.

^{viii} Energy, food security, urbanization and settlement, water resources, land resources, coastal and marine resources, forecasting and futures, decision-making and uncertainty, industry trade and investment, geopolitical issues, legal dimensions, integrated programs

^{ix} Steve Schneider makes the observation that media stories about climate change often used 'weather pegs' to set up an article about longer term trends (Schneider, 1989, p. 192)